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Development of Information Quality Engineering (IQE) Methodology for Information Resource Management

A Research Task Sponsored

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The purpose of this project was to demonstrate the applicability and efficacy of the IQE methodology to develop a Quality Assurance/Quality Control system approach to enhance quality and productivity of the information support activity of DARPA. The IQE methodology was used to develop a model for the DARPA information system and a system architecture. Work was then suspended on the project because of an internal realignment within DARPA which resulted in revised IRM policies. Study effort was then directed at finding an alternative area where the IQE technique could be applied. The use of IQE in developing war game/proto-

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cols for the exchange of information between concurrently running war games appears to have merit.

CONTENTS

1.0 INTRODUCTION

This is the final report under contract DAAH01-88-C-0105, Technical Requirement Number N369, ARPA Order Number 6208. The report contains three chapters. This chapter provides a brief overview of the project requirements. The second chapter reviews the major events in the project's life. The final chapter provides a recommendation for an alternative demonstration of the utility of Information Quality Engineering (IQE) techniques in resolving information resource management problems.

1.1 PURPOSE

The purpose of this project was to demonstrate the applicability and efficacy of the IQE methodology to develop a Quality Assurance/Quality Control (QA/QC) system approach to enhance the quality and productivity of the information support activities of DARPA.

1.2 TASKS

VRI was tasked to perform the following work:

- Coordinate with the User's Group to quickly develop an initial information model that identifies relationships and associations between organizational areas of responsibility and organizational goals, issues, and problems.
- Develop an initial model of DARPA's operations, concentrating on subject areas and functions, and coordinating with the User's Group to refine the model to ensure that the resultant information architecture will support both management and operational uses of information and that differing requirements for

information at various levels of the organizational hierarchy are satisfied in a consistent fashion.

- Analyze the information capabilities and resources of current DARPA systems in order to develop specific recommendations for consideration by the User's Group to bring the current environment closer to the model developed. In this regard, define and prioritize hardware, software, and procedural modifications required to improve information quality and enhance DARPA productivity.

1.3 FUNCTIONAL CAPABILITIES REQUIRED

The new information model should focus on integrating the following capabilities:

- information management;
- document preparation;
- financial analysis and planning; and
- communications coordination.

The next chapter highlights the major work accomplished by VRI in meeting the tasks and requirements.

2.0 MAJOR IQE ACTIVITIES

This chapter reviews the major project milestones. VRI was engaged by the Technology Assessment and Long Range Planning Office (TALRPO) of DARPA to demonstrate the applicability and efficacy of the IQE approach, a VRI-developed discipline, to IRM. The contract to perform this work was signed on 1 December 1987 and the work was to be completed not later than 31 May 1988.

2.1 INITIAL EFFORTS

The three tasks of the contract, cited in the previous chapter, required VRI to develop a QA/QC program using IQE tools, which would be validated within DARPA's information support activities. VRI conducted an extensive and systematic review of information requirements developed by DARPA's senior managers as recorded in the "DARPA Information System Study" compiled by American Management Systems, Incorporated, and DARPA's MIS activities.

In accomplishing the first task under the contract, VRI used information distilled from the study cited above and IQE techniques to develop a model of the DARPA information system. This model and a current model of DARPA's data processing operations were described in a briefing to TALRPO in January 1988. The thrust of this briefing was to outline possible directions for IRM process to take in the future.

2.2 SUBSEQUENT EFFORTS

Following the initial efforts described above, as part of the remaining two tasks under the contract, VRI prepared an overall draft

system architecture and decision paper outlining the range of system options available to DARPA, which would meet the Agency's information requirements.

At this point changes in senior management and functional realignment within DARPA made it obvious that the DARPA IRM policies were going to be considerably different than conceived initially. With these changes, the scope of the IRM enhancement to the information system was reduced. The decrease in scope of the project also preempted further work on demonstrating the applicability and efficacy of IQE. For this reason all work on the contract was suspended pending clarification and a decision relative to the future of MIS enhancement within DARPA. At the same time, March 1988, action was initiated to extend the contract for one year.

2.3 IRM SCALE-BACK

After the contract was extended, DARPA made the decision to scale-back the IRM effort and to resolve the data processing issue by employing a Macintosh-based MIS. In light of this new thrust VRI was assigned two tasks under the revised contract.

First, VRI leased three Macintosh computers for 11 months beginning in July 1988. These machines were used by the Prototype Planning Office (PPO) as part of the internal DARPA information system.

Second, VRI began investigating other areas within DARPA where the IQE concept could be applied and validated. The results of this investigation are contained in the next chapter.

3.0 VALIDATING THE IQE CONCEPT

In this chapter an alternate means of validating the IQE tools is discussed. Because of the change in direction in the development of an enhanced MIS for DARPA the IQE methodology was not sufficiently exercised to demonstrate its applicability and efficacy as a technology tool for IRM. Based on the assumption that the requirement to evaluate this methodology is still valid, an alternative approach to meeting this need is presented.

3.1 ALTERNATIVE PROGRAM

The high information content of war games makes them ideal candidates for the application of IRM techniques and excellent vehicles for the validation of the universally adaptable IQE tools. The work currently being accomplished by PPO for General Galvin, Supreme Allied Commander Europe (SACEUR), to develop a distributed war gaming capability to tie all of the Corps in NATO together appears to be an ideal project upon which to validate IQE techniques.

3.2 APPLYING IQE TOOLS TO THE PROJECT

VRI's work in developing the IQE tools has resulted in the identification of seven principal information quality assurance and quality control (QA/QC) functions. These functions have direct application in the exchange of information between operational staffs at the highest levels of command in both training and combat environments. These QA/QC functions are:

- model the information system;
- define quality objectives;
- define quality standards and measure performance;
- identify cost-effective system changes to improve information quality;
- establish internal feedback; and
- perform periodic quality reporting.

It is clear that the IQE approach has wider applicability and, in particular, is applicable to an information quality-based approach to information resource management within military command posts and operational headquarters.

3.3 DEVELOPMENT OF WAR GAMING PROTOCOLS

One of the most promising uses of the IQE tools would be in the development of war gaming protocols, which could be used to specify, control, and validate the data to be exchanged between various war games running concurrently and complimentarily. VRI understands the requirement for war game information exchange protocols and has an innovative top-down approach to their development. A key problem to be resolved in this effort is identifying what information is required to be exchanged between players in concurrently running games.

It is noted that the protocols being discussed here are not communication protocols in the sense of TTY or X.25 protocols; instead they are a description of the form, quantity, and quality of data which must necessarily be exchanged between different war game models and their players in a single exercise.

3.4 PROPOSED WORK

VRI proposes that the IQE approach be validated by the use of these tools in developing war game protocols which have the potential to significantly enhance DARPA's contribution to the improvement of war games within DoD.

The objectives of this work are to:

- demonstrate the applicability and efficacy of the IQE approach to IRM in support of war games; and
- develop prototype war game protocols that provide for the exchange of information between players at various player levels and between various combat assessment and accounting models used in the control of war games.

During this research effort VRI proposes to perform the following tasks:

- Task 1: Review a small number of different war gaming systems (land, sea, and air) to identify their salient information requirements and data generation capabilities in order to identify what information is essential for the conduct of joint operations during this set of war games. The findings of this review will be presented in the form of an information system model.
- Task 2: Draft representative protocols, for a type joint war game, to serve as a model for a generic set of protocols.
- Task 3: After tasks 1 and 2 are complete, develop a set of war game protocols.

3.5 SUMMARY

This report has reviewed the work performed by VRI in applying the IQE approach to IRM within DARPA. The fact that the work on DARPA's information management system was revised in mid-course resulted in the IQE methodology not being properly evaluated. This final chapter of the report provides a proposal for an alternative method of evaluating the IQE methodology and tools.